



Species

Neoscona Simon, 1864, the 'True Orb Weavers' in Ricelands of Gangetic Delta, South 24-Parganas, West Bengal, India

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General Note



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ABSTRACT

Deliberate usage of various chemical pesticides in different agro ecosystems for decades has not only created a serious threat to human body affecting its healthy sustenance but also to the environment as a whole. Considering the importance of spiders as a predator to check the pest population, these are thought to be an effective eco-friendly supplement to the chemical based protection. The present communication, therefore, is an endeavor to explore the diversity and distribution of the members of the genus *Neoscona* Simon, 1864, a true orb weaver, in the rice lands of Gangetic Delta, South 24-Parganas, West Bengal, India. As no data is available from the referred ecosystem till date, it is worthwhile to mention that this is the second largest group encountered during our study.

Keywords: *Neoscona* Simon, 1864, Orb Weaver, Riceland, South 24-Parganas, West Bengal, India

Abbreviations: TL: Total length, CL: Cephalothorax Length, CW: Cephalothorax Width, AL: Abdominal Length, AW: Abdominal Width, AME: Anterior Median Eye, ALE: Anterior Lateral Eye, PME : Posterior Median Eye, PLE: Posterior Lateral Eye, CHL: Chelicera, STR: Sternum, DH: Dorsal Habitus, SCA: Scape (Anterior View), SCL: Scape (Lateral View), MLP: Male Palp, FIG: Female Internal Genitalia

1. INTRODUCTION

Usage of different chemical pesticides in various agricultural systems like Ricelands is rather a common practice across the globe. This is supposed to be the most effective measure of pest control as of today despite knowing their ill effects. Undoubtedly, it is a potential threat against the sustenance of humankind. Therefore, it has become the need of the hour to have a good and eco-friendly supplement to chemical based plant protection that may reduce the pesticide load thus enhancing the quality of mankind. It is imperative to explore the possibilities of use of natural biotic agent/s like spiders that may put a check on the pest population.

Assessing spiders as a potential predator in any ecosystem may be considered as an initial step of the overall management procedure. They even exhibit beautiful top down effect in controlling pests. However, because of insufficient data bank, the predatory role of spiders inhabiting agricultural systems is still controversial. Apart from a few handful information from some European studies, this area demands serious consideration to establish the sad fact (Nyffeler and Benz, 1987).

In India, especially with reference to Riceland, unfortunately the role of spiders as a potential bio-control agent is yet to be evaluated. Excepting a few information available from Tamil Nadu and from Kerala (Sebastian and Chacko, 1994; Sebastian, Mathew, Beevi, Joseph and Biju, 2005; Sudhikumar, Mathew, Sunish and Sebastian, 2005; Dhali and Sureshan, 2016) and some report from other parts of this country (Chelliah, Bentur and Prakasa Rao, 1989; Meera Gupta and Pawar, 1982; Rajendra, 1987; Banerji *et al.* 1993; Ganesh Kumar, 1994; Pathak and Saha, 1999; Chapke and Raja, 2015), nothing is worth-mentioning till date. Though the database is almost weak with respect to West Bengal, the reports by Roy (2013) on the role of predatory spiders in tea ecosystem of Dooars, Eastern Himalaya, and by Satpathi (2004) on the predatory potential of spiders are significant.

We, since recent past, have initiated a sustained study to unfold the position of spiders in Riceland ecosystem of Gangetic Delta. During the course of study, the long-jawed orb weaving spider *Tetragnatha* Laterallie, 1804, (Tetragnathidae) is found to be the most dominant group in terms of richness and distribution (Basu and Raychadhuri, 2016). Interestingly, *Neoscona* Simon, 1864, a true orb weaver, comes immediately after. Following section is the detail of the six *Neoscona* species encountered in the referred ecosystem.

2. STUDY AREA

Seven discrete areas of South 24 Parganas (22.1352° N, 88.4016° E), a district of West Bengal, located near the confluence of the river Ganges sharing a considerable part of the largest delta of the world, are selected as study sites (for further details see Basu and Raychaudhuri, 2016).

2.1. Time of study

Field visits were carried out in every month of any calendar year during the crop seasons. It was continued for three successive years, 2014 to 2016. The annual rainfall (average) in the district was 1796 mm. Temperature in the study areas varied from 10°C to 35°C during course of study.

3. MATERIALS AND METHODS

For collection of spiders, sweep nets, bush beating and collection in inverted umbrella, hand picking techniques were used. Several pit fall traps were laid in the collection localities to trap ground dwelling spiders. Samples after collection [collector: D. Basu] were preserved in 70% alcohol and later transferred to glass vials filled with Audman's fixative. Necessary labels were used to mark each of the samples. Data regarding locality, date of collection, collector's name were noted in a note book in the field itself. The samples were studied under Sterozoom Binocular Microscopes Olympus SZX 10 and SZX 16. Line drawings were made with the aid of necessary accessories attached to the microscopes. Photographs were taken by a digital camera attached to the microscopes. All measurements are in millimeters, made with an eye piece graticule.

3.1. Deposition

All materials are in the collection of Department of Agricultural Biotechnology, IRDM Faculty Centre, RKM Vivekananda University, Narendrapur.

4. RESULTS

4.1. Taxonomy

Often called the 'True Orb Weaver,' after the cryptic, brightly-colored, swirling markings on its prominent abdomen, this spider, *Neoscona Simon*, 1864, can be found in agricultural fields, forests, gardens, and on human structures. Members of the genus have a longitudinal thoracic groove in the cephalothorax. Median ocular quadrangle slightly longer than wide, forming a trapezium. AME the largest or subequal to PME. Lateral eyes close to each other and not borne on prominent tubercles. PLE is the smallest. Eye rows recurved. Coxa I of male with a ventral hook on the distal rim. Tibia II with strong pro-lateral spines. Abdomen ovoid, sub-ovoid, triangular, or subtriangular. Epigynum simple and tongue-like, scape completely fused basally, with one or two pairs of lateral lobes. Epigynal openings underneath the scape. Patella of male's pedipalp with two strong, curved, and long spines. Cymbium broad (Tikader, 1982). Females range in size from 5–7 mm and males 5–6 mm (BugGuide, 2017).

4.2. Distribution

Neoscona species are among the most common and abundant orb weavers and are found in all continents (Berman and Levi, 1971). As of today, 115 species under this genus have been discovered including 26 Indian species. It is worthy to mention that 14 species of *Neoscona* are endemic to India till date (Sebastian and Peter, 2008; World Spider Catalog, 2017).

4.3. Key to species

1. Cephalic region forming a snout, in male median apophysis sickle shaped and terminal apophysis rectangular **yptinika** Barrion & Litsinger
- Cephalic region not snouted 2
2. Abdomen sub triangular with a pair of anterolateral humps; sternum bifid distally; scape short, blunt, with lateral lobes distinct; copulatory duct inwardly curved with distinct opening, fertilization duct straight **punctigera** (Doleschall)
- Abdomen sub triangular, without hump 3
3. Epigynal scape constricted, either at bending point or at the middle 4

- Epigynal scape not constricted, right angle to the base, lateral lobes inconspicuous, spermathecae elongate oval

..... **bengalensis** Tikader & Bal

4. Cephalothorax longer than wide with two lateral bands, abdomen dark-brown, mid longitudinally with chalk- white bands margined with four pairs of sigillae, copulatory duct nearly straight with distinct opening

..... **theisi** (Walckenaer)

- Cephalothorax not longer than wide

..... 5

5. Thoracic fovea diamond shaped; lateral lobe of scape distinct; spermatheca bean shaped

..... **vigilans** (Blackwall)

- Thoracic fovea not so, abdomen over hanged; lateral lobe of scape in distinct; spermatheca elongate oval

..... **nautica** (L. Koch)

***Neoscona yptinika* Barrion & Litsinger, 1995**

Neoscona yptinika Barrion & Litsinger, 1995, *Riceland Spiders of South & Southeast Asia*: 620.

(Figs: 1 - 5; plate – 1: i – v); DH: Fig.1 & Plate 1(i); CHL: Fig 2 & Plate 1(ii); STR: Fig 2 & Plate 1(v); MLP (Dorsal): Fig 4, Plate 1(iv); MLP (Ventral): Fig 5, Plate 1 (v).

Measurements (male): CL – 4.08, CW – 3.85, AL – 4.07, AW – 3.23, TL – 8.15.

Inter-ocular distance: AME – AME= 0.30, ALE – AME= 0.58, ALE – ALE = 1.28, PME – PME= 0.30, PLE – PME= 0.54, PLE – PLE = 1.38, ALE – PLE = 0.46, AME – PME = 0.30.

Legs: I 12.56 (4.00, 1.71, 1.14, 1.57, 4.14), II 11.27 (3.71, 1.28, 1.71, 1.57, 3.00), III 8.99 (3.71, 1.14, 1.57, 1.71, 0.86), IV 14.29 (3.71, 1.43, 2.86, 3.00, 3.29). Leg formula 4123.

Material Examined: 2♂♂, ARPH, 22.III.2014; 1♂, NPUR, 18.X. 2015.

Distribution: India: West Bengal; Philippines (Barrion and Litsinger, 1995; Sen *et al.*, 2011; Roy *et al.*, 2013; Dhali and Sureshan, 2016; World Spider Catalog, 2017).

***Neoscona punctigera* (Doleschall, 1857)**

Epeira punctigera Doleschal, 1857, *Nat. Tijdschr. Neder.- Ind.*, 13: 420.

Neoscona punctigera (Doleschall) Roberts, 1983, *Zool. J. Linn. Soc.*, 77: 275.

(Figs: 6 - 11; plate – 1: vi - xi); DH: Fig.6 & Plate 1(vi); CHL: Fig 7& Plate 1(vii); STR: Fig 8& Plate 1(xi); SCL: Fig 9, Plate 1(ix); SCA: Fig 10, Plate 1(x); FIG: Fig 11, Plate 1(viii).

Measurements (female): CL – 4.90, CW – 4.70, AL – 9.10, AW – 8.80, TL – 13.70.

Inter-ocular distance: AME – AME=0.50, ALE – AME=1.0, ALE – ALE = 1.50, PME – PME= 0.40, PLE – PME= 1.20, PLE – PLE = 1.80, ALE – PLE = 0.40, AME – PME = 0.40.

Legs: I 16.44 (4.72, 2.72, 4.14, 3.57, 1.29), II 14.43 (3.57, 2.72, 3.71, 3.29, 1.14), III 9.85 (3.57, 1.86, 2.28, 1.14, 1.00) IV 16.71 (4.57, 2.43, 3.85, 4.29, 1.57). Leg formula 4123.

Material Examined: 2♀♀, MSDP, 16.XI. 2015.

Distribution: India: Gujarat, Maharashtra, West Bengal; Austro-Malaysia, China, Japan, Reunion, South New Guinea (Tikader, 1982; Roy, 2013; World Spider Catalog, 2017).

***Neoscona bengalensis* Tikader & Bal, 1981**

Neoscona bengalensis Tikader & Bal, 1981, *Rec. Zool. Surv. India, Occ. Pap.*, 24:15.

(Figs: 12 - 17; plate – 1: xii - xvii); DH: Fig.12 & Plate 1(xii); CHL: Fig 13 & Plate 1(xiii); STR: Fig 14 & Plate 1(xvii); SCL: Fig 15, Plate 1(xvi); SCA: Fig 16, Plate 1(xv); FIG: Fig 17, Plate 1(xiv).

Measurements (female): CL – 4.20, CW – 4.00, AL – 7.11, AW – 7.23, TL – 11.31.

Inter-ocular distance: AME – AME=0.50, ALE – AME= 0.90, ALE – ALE = 2.30, PME – PME= 0.40, PLE – PME= 0.90, PLE – PLE = 1.10, ALE – PLE = 0.35 , AME – PME = 0.40.

Legs: I 14.80 (4.34, 1.34, 3.67, 4.00, 1.45), II 13.84 (3.71, 1.71, 3.57, 3.57, 1.28), III. 8.75 (2.30, 1.38, 2.00, 1.84, 1.23), IV.11.12 (2.89, 1.23, 3.00, 3.00, 1.00). Leg formula 1243.

Material Examined: 1♀, KKDP, 20.II.2014; 6♀♀, NPUR, 20.II.2015; 2♀♀, GSBA, 10.X. 2016.

Distribution: India: Assam, West Bengal; Bangladesh, Pakistan (Tikader, 1982; Biswas and Biswas, 1992; Kundu and Raychaudhuri, 1997; Majumder, 2005; Roy *et al.*, 2013; Sebastian and Peter, 2009; Sen *et al.*, 2009; World Spider Catalog, 2017).

***Neoscona theisi* (Walckenaer, 1841)**

Epeira theisi Walckenaer, 1841, *Hist. Nat. des Ins. Apteres. Paris*, 2:53.

Neoscona theisi (Walckenaer) F.O.P.- Cambridge, 1904, in *Biologia Centrali-Americana, Zool. Lond.*, 2:470.

(Figs: 18 - 23; plate – 2: xviii - xxiii); DH: Fig.18 & Plate 2(xviii); CHL: Fig 19 & Plate (xix); STR: Fig 20 & Plate 2(xxiii); SCL: Fig 21, Plate 2(xxii); SCA: Fig 22, Plate 2(xxi); FIG: Fig 23, Plate 2(xx).

Measurements (female): CL – 3.35, CW – 3.11, AL – 5.82, AW – 4.88, TL – 9.1.

Inter-ocular distance: AME – AME= 0.29, ALE – AME= 0.52, ALE – ALE = 1.29, PME – PME=0.29, PLE – PME=0.53, PLE – PLE = 1.29, ALE – PLE = 0.17, AME – PME = 0.23.

Legs: I 12.80 (3.67, 1.56, 2.89, 3.56, 1.12), II 10.98 (3.22, 1.22, 2.66, 2.88, 1.00), III 8.00 (2.61, 1.00, 1.54, 1.85, 1.00), IV 10.78 (3.78, 1.22, 2.78, 2.00, 1.00). Leg formula 1243.

Material Examined: 5♀♀, GSBA, 09.XI. 2014; 5♀♀, NPUR, 16.XI.2014; 12♀♀, MSDP, 16.II.2015; 15♀♀, NPUR, 06.XI.2015; 12♀♀, GSBA, 09.XI.2015; 5♀♀, ARPH, 14.XII.2015; 15♀♀, GSBA, 25.II.2015; 16♀♀, NPUR, 20.I. 2016; 8♀♀, NMPT, 12.X.2016; 21♀♀, ARPH, 19.XII.2016.

Distribution: India: Gujarat, Madhya Pradesh, Maharashtra, Orissa, West Bengal; China to Pacific Island, New Guinea (Tikader, 1982; Biswas and Biswas, 1992; Barrion and Litsinger, 1995; Kundu and Raychaudhuri, 1997; Gajbe, 2004; Majumder 2007; Roy *et al.*, 2009; Saikia and Baruah, 2009; Dhali and Sureshan, 2016; World Spider Catalog, 2017).

***Neoscona vigilans* (Blackwall, 1865)**

Epeira vigilans Blackwall, 1865. *Ann. Mag. Nat. Hist.* (3) **16**: 336-352.

Araneus rumpfi Thorell, 1900. *The fauna of British India, including Ceylon and Burma.*

Arachnida. London, 1-279.

Araneus rumpfi Tikader, 1982. *Fauna of India*, 2: 1-533.

(Figs: 24 - 29; plate – 2: xxiv - xxix); DH: Fig.24 & Plate 2(xxiv); CHL: Fig 25 & Plate (xxv); STR: Fig 26 & Plate 2(xxix); SCL: Fig 27, Plate 2(xxviii); SCA: Fig 28, Plate 2(xxvii); FIG: Fig 29, Plate 2(xxvi).

Measurements (female): CL – 2.62, CW – 3.15, AL – 6.15, AW – 5.38, TL – 8.77.

Inter-ocular distance: AME – AME= 0.38, ALE – AME= 0.54, ALE – ALE = 1.31, PME – PME=0.38, PLE – PME=0.53, PLE – PLE = 1.37, ALE – PLE = 0.18, AME – PME = 0.26.

Legs: I 12.13 (3.67, 1.45, 3.00, 2.89, 1.12), II 10.91 (3.34, 1.12, 2.67, 2.89, 0.89), III 7.53 (2.30, 1.00, 1.54, 2.00, 0.69), IV 10.12 (3.00, 1.00, 2.67, 2.67, 0.78). Leg formula 1243.

Material Examined: 2♀♀, KKDP, 10.X.2015.

Distribution: India: Chingleput, Ootacamund, Tamil Nadu; Bangalore, Karnataka ; Wagarkaroor, A.P.; Poona, Maharashtra; Orissa. Sri Lanka: Punduloya, Trincomali. Burma : Rangoon, Tharrawaddy, Bhamo. Pakistan: Karachi. Indo and Austro Africa to Philippines, New Guinea (Tikader, 1982; Dhali and Sureshan, 2016; World Spider Catalog, 2017)

***Neoscona nautica* (L. Koch, 1875)**

Epeira nautical L. Koch, 1875, *Aegyptische und abyssinische Arachnidengesammelt von Herrn C. Jickeli*. Nurnberg: 17.

Neoscona nautica (L. Koch) Petrunkevitch, 1930, *Trans. Connect. Acad. Arts Sci.*, 30:320

(Figs: 30 - 35; plate – 2: xxx - xxxv); DH: Fig.30 & Plate 2(xxx); CHL: Fig 31 & Plate (xxxi); STR: Fig 32 & Plate 2(xxxv); SCL: Fig 33, Plate 2(xxxiv); SCA: Fig 34, Plate 2(xxxiii); FIG: Fig 35, Plate 2(xxxii).

Measurements (female): CL – 2.38, CW –, AL – 6.00, AW –, TL – 8.38

Inter-ocular distance: AME – AME= 0.38, ALE – AME= 0.52, ALE – ALE = 1.15, PME – PME=0.38, PLE – PME=0.53, PLE – PLE = 1.38 , ALE – PLE = 0.17 , AME – PME = 0.23.

Legs: I 14.14 (4.23, 1.56, 3.34, 3.67, 1.34), II 11.57 (3.45, 1.67, 2.45, 3.00, 1.00), III 8.75 (2.30, 1.38, 2.00, 1.84, 1.23), IV 11.12 (2.89, 1.23, 3.00, 3.00, 1.00). Leg formula 1243.

Material Examined: 5♀♀, NPUR, 11.X. 2015.

Distribution: India: Gujarat, Madhya Pradesh, Maharashtra, Meghalaya, West Bengal; Burma, North America, Pakistan, Philippines (Tikader, 1982; Biswas and Biswas, 1992; Barrion and Litsinger, 1995; Kundu and Raychaudhuri, 1997; Gajbe, 2004; Saha and Raychaudhuri, 2004; Majumder 2007; Roy *et al.*, 2009; Sebastian and Peter, 2009; World Spider Catalog, 2017).

5. DISCUSSION AND CONCLUSION

Spiders do not consume only pestiferous herbivores. Being generalists, they feed on more than one trophic level in a food web (Morin, 1999). Although model food webs predict that polyphagy will lead to instability, studies of a natural community show that food chains containing generalists are more stable (Wise *et al.*, 1999). Therefore, it is evident that, as a predominant general

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predator existing in the Riceland ecosystem for a long time, this group plays a seminal role in pest management and thus, this mode of control may claim the status of an effective supplement to chemical control.

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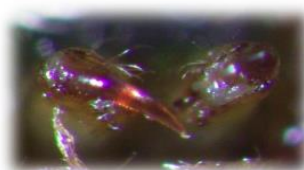
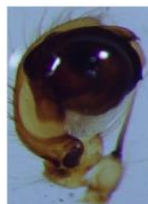
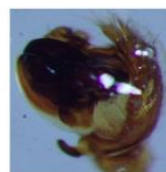
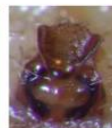
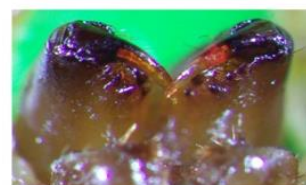
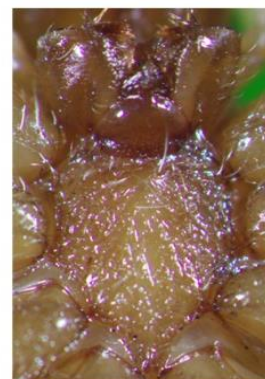
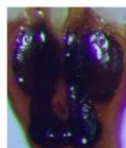
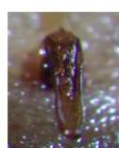
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Plate 1

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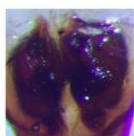
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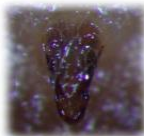
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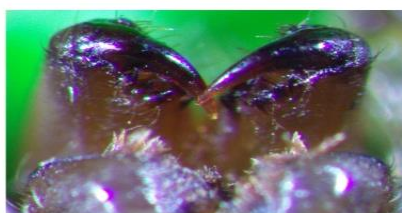
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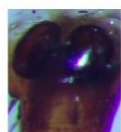
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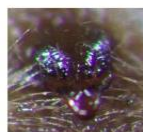
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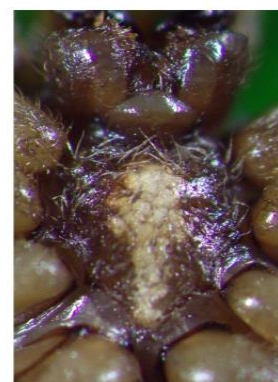
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xxvii



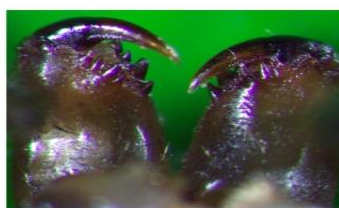
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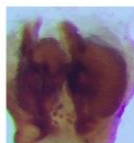
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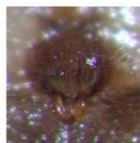
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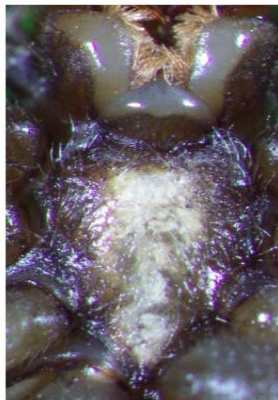
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xxxiii



xxxiv



xxxv

Plate 2

